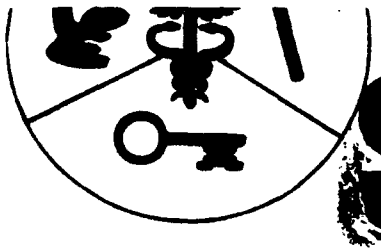

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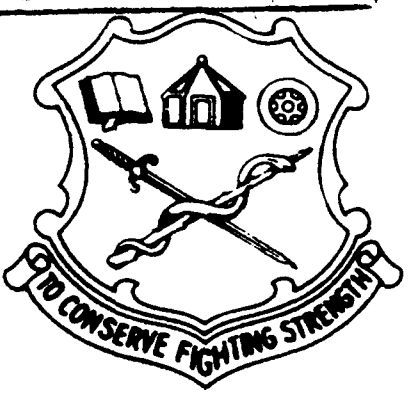
KNOWLEDGE, ATTITUDE, AND BEHAVIOR OF FAMILIES LIVING IN A NATURAL HIGHLY FLUORIDATED COMMUNITY AT FORT IRWIN, CALIFORNIA

DCR 94-002

June 1994



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(U) A study was conducted at Fort Irwin, which is a natural highly fluoridated area, to determine the type of water used for drinking and cooking purposes and to investigate the knowledge, attitude, and behavior of post residents toward fluoride. Approximately 63% of households with children responded to the questionnaire. While only 7.6% of parents claimed their children drank tap water, in-processing and family housing personnel need to improve their education of incoming soldiers and their families when discussing tap water consumption at Fort Irwin and its possible effects on children's teeth.

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EXECUTIVE SUMMARY

A study was conducted at Fort Irwin, which is a natural highly fluoridated area, to determine the type of water used for drinking and cooking purposes and to investigate the knowledge, attitude, and behavior of post residents toward fluoride. Approximately 63% of households with children responded to the questionnaire. While only 7.6% of parents claimed their children drank tap water, in-processing and family housing personnel need to improve their education of incoming soldiers and their families when discussing tap water consumption at Fort Irwin and its possible effects on children's teeth.

BACKGROUND

For more than 40 years, water fluoridation has been the dominant factor in the declining prevalence of dental caries. In 1962, the U.S. Public Health Service (USPHS) established the optimal concentration of fluoride in drinking water based on the annual average of maximum daily air temperature. For the continental U.S. this optimal fluoride concentration ranges from 0.7 to 1.2 mg of fluoride per liter of water (0.7 to 1.2 ppm fluoride). It was intended to prevent dental caries while minimizing dental fluorosis. Based on the USPHS' recommendations, southern regions of Texas and Florida should maintain an adjusted water fluoride level of 0.7 ppm fluoride. Most of Maine and northern regions of New Hampshire, Vermont, New York, Michigan, Wisconsin, Minnesota, and North Dakota should maintain an adjusted fluoride concentration of 1.2 ppm fluoride. Fort Irwin, located in southern California, should follow the USPHS' recommendation of 0.8 ppm fluoride.

However, Fort Irwin's water source is naturally fluoridated at approximately 6.0 to 8.0 ppm, well above the optimal level. At that concentration of fluoride, the Environmental Protection Agency (EPA) has the authority to reject the water for drinking purposes due to adverse health reasons according to the 1975 National Interim Primary Drinking Water Regulations. Because EPA considers dental fluorosis to be cosmetic and not an adverse health effect, it has set the maximum contaminant level (MCL) for

fluoride at 4mg/L of drinking water. The MCL level of 4 ppm fluoride is well below the concentration of fluoride that may lead to crippling skeletal fluorosis or other adverse health effects. However, because of increasing levels of background fluorides found in foods, beverages processed with fluoridated water, toothpaste, fluoride supplements and other dental products, the EPA recently requested a review of the MCL. The National Research Council's Board on Environmental Studies and Toxicology established the Subcommittee on Health Effects of Ingested Fluoride to determine whether EPA's MCL of 4mg/L was still acceptable for protecting the public from potential adverse health effects of fluoride. By August 1993, the subcommittee concluded that EPA's MCL of 4mg/L for fluoride is still appropriate.

Because Fort Irwin's water supply is above the MCL for fluoride, the post partially defluoridates a portion of the water supply for drinking and cooking purposes. The process used in defluoridation at Fort Irwin is called reverse osmosis (RO), and the RO water (0.6 - 0.7 ppm F) is supplied to each house through a special spout located at the kitchen sink. While the intent was for families to use RO water for drinking and cooking, they may in fact be using tap water (6.0 - 8.0 ppm F) or bottled water ranging in fluoride content from 0.1 to 1.0 ppm F.

The aims of this study were (1) to determine the type of water actually used for drinking and cooking purposes and

(2) to investigate the knowledge, attitude, and behavior toward fluoride with families living in a naturally high fluoridated community.

METHODS

A cross-sectional study was designed employing a questionnaire designed by the authors and reviewed by the Division of Oral Health at Centers for Disease Control (CDC). Survey questionnaires were distributed by the Fort Irwin dental clinic personnel to post housing units in October 1993. Residents were asked to complete the survey if they had children residing with them, and return the questionnaire in a postpaid envelope to the Directorate of Health Care Studies and Analyses at Fort Sam Houston.

Residents were asked demographic questions such as children's birth dates, sponsor's rank, parents' educational level, and household income. Other questions addressed the knowledge, attitude, and behavior as they relate to water consumption at Fort Irwin. We asked families how knowledgeable they were about fluoride, fluorosis, and the potentially harmful effects of excessive levels of fluoride. If they felt informed about these issues, we asked how they received their information (through official or other channels). To assess their attitudes about water consumption, residents were asked if they felt there was a problem with adults and/or children drinking the tap water at Fort Irwin. In addition, we asked about practices regarding children's consumption of three types of water on Fort Irwin: tap water which contains excessive levels of fluoride (6-8 ppm), RO water available through a special spout in family housing

which contains approximately the optimum level of fluoride for the area (0.6-0.7 ppm), and bottled water sold in the area which ranged in fluoride concentration from 0.1 ppm to 1.0 ppm.

We asked parents about the oral hygiene practices of their children to include the children's last dental appointment, the age their teeth were first brushed with toothpaste, and how often their teeth were brushed with toothpaste.

Chi-square statistics were used to determine if any association existed between education, income, personal or professional dental care, and the parent's knowledge, attitude, and behavior regarding the use of highly fluoridated tap water. The bivariate analyses were performed using PC-SAS with an alpha of 0.05 for all tests.

RESULTS

Sample Results

Of the 1240 surveys hand delivered to households with children, 780 were returned. The response rate was 62.9%. More than two-thirds of the surveys were filled out by the children's mothers.

Demographics

Of the 780 families studied, the average family had 2.2 children, nearly half of whom were less than 6 years of age. Sixty-eight percent of the military members were enlisted, half having the rank of E-6 or less. We also collected data on education and household income. There was an even split between the mother's educational level up to high school and beyond the high school level. However, fathers presented with an overall higher educational level with 56% having some college education. Three hundred and forty-five of the 780 households reported incomes of $30,000 or greater. Nearly half of households in this higher income bracket fell between $30,000 to $39,999 while 180 households reported incomes of $40,000 or greater.

Knowledge

While 91% of families claimed they were knowledgeable about fluoride, only 8% knew the meaning of fluorosis. More than three-quarters of the parents surveyed claimed they had been told

not to have their children drink tap water. However, 58% had been warned that their tap water contained more fluoride than most drinking water in the U.S. The majority of those informed had been told through official channels; however, nearly one-quarter had been informed through a neighbor, co-worker, or acquaintance.

More important than knowing about fluoride is being aware that additional fluoride in tap water can be potentially harmful to children's teeth. For those who knew that their tap water contained additional fluoride, three-quarters felt it could be harmful to their children's teeth. Half of those knowledgeable about the additional fluoride stated that it may discolor their children's teeth.

We also asked questions concerning professional and personal dental care. Eighty-six percent of parents claimed their children had a dental appointment within the year, while only 14% of parents had children whose last dental appointment was at least 2 years ago. Nearly three-quarters of parents said they brushed their children's teeth at age one or earlier with 27% of parents waiting until their children turned 2 or later. Nearly 90% of parents claimed that their children brushed their teeth at least once a day.

Parents were also questioned about products containing fluoride that may be potentially harmful to their children's teeth. Surprisingly, nearly 40% of parents felt that too much toothpaste swallowed at a young age could be harmful. Fifty-four

percent felt that too many fluoride tablets taken during childhood may also be harmful. However, only 12% of parents knew that certain foods, such as fish, or drinks, such as tea, may contain high concentrations of fluoride.

Attitude

Nearly 80% of parents felt there was a problem for adults drinking water high in fluoride, with the majority stating that the water was unsafe to drink. Parents were even more concerned for their children. Ninety percent of parents felt there was a problem for children drinking water high in fluoride.

Behavior

Whether parents knew about the additional fluoride in drinking water or not, only about 7.6% of parents claimed their children either drank tap water or beverages made with tap water. For those children who drank tap water, the reasons most frequently given were convenience, free of charge, or tastes better.

When most children drank water, they either drank RO water or bottled water mainly because it was better for them than tap water. Reasons also given were that RO water is more convenient and bottled water tastes better than tap water.

Bivariate Analysis Results

Six variables were analyzed for their association with knowledge, attitude, and behavior patterns toward highly fluoridated tap water. Using a 95% confidence interval, three variables were associated with either knowledge of additional fluoride in tap water and/or parental behavior regarding the consumption of the highly fluoridated tap water. Not surprisingly, mother's education was significantly associated with both knowledge ($p = 0.004$) and behavior ($p = 0.003$). Mothers who were educated beyond high school were more likely to have knowledge of the additional fluoride in tap water than mothers educated at or below the high school level. Furthermore, more educated mothers were more likely to have children who did not drink the highly fluoridated tap water. Surprisingly, father's educational level was significantly associated with only behavior ($p = 0.028$). College educated fathers were more likely to have children who did not drink tap water. Household income was also significantly associated with behavior ($p = 0.001$). Children living in households where the combined annual income was $30,000 or greater were less likely to drink tap water than those children whose parents made less than $30,000.

The three variables having to do with dental care, whether professional or personal, were not associated with knowledge, attitude, and behavior toward highly fluoridated tap water. In this case, it does not seem to matter how frequently parents take

their children to visit the dentist or when and how frequently children's teeth are brushed with toothpaste.

DISCUSSION

Approximately 10 million people in the U.S. reside in communities that have naturally fluoridated water sources with fluoride concentrations of 0.7 ppm or greater (Centers for Disease Control, 1993). Of those, only a small percentage have water supplies with fluoride concentrations at or above the MCL. Fort Irwin is one such community.

Anecdotal information lead us to believe that residents at Fort Irwin were not knowledgeable about fluorides and, in particular, the high fluoride concentration in their tap water. It was also suspected that many residents, especially children, were drinking tap water rather than RO water. It was heart-warming to discover that 9 out of 10 families surveyed expressed knowledge about fluorides and nearly 60% had been informed that their tap water was over fluoridated and should not be used for drinking purposes. Not only were the majority knowledgeable about the additional fluoride in their tap water, but they knew that the high fluoride may be harmful to their children's teeth. Their dental knowledge spilled over into dental products containing fluoride. Again they showed substantial knowledge by indicating that too much fluoride ingested could be harmful to their children's teeth. Often as professionals, we do not give lay persons the benefit of knowing much about dental materials or products. It was refreshing to have a community that is basically well informed. The only disturbing fact was that

nearly one-quarter of families were made aware of the additional fluoride through other than official channels. In-processing and family housing personnel need to improve their education of incoming soldiers when discussing tap water and its possible effects on children's teeth.

In-processing and housing personnel must also be aware that their efforts should be directed to those of lesser educa and rank. Officials also must recognize that the mother's role in either knowledge or behavior is more significant than the father's. Mothers, who only have a high school diploma or less, are less likely to be knowledgeable about fluorides, in general, or about the additional fluoride found in tap water, in particular. When it came to behavior patterns, whether children drank tap water or not, more variables became significant. Educational level of both parents and the rank of the children's sponsor were significant factors in determining the likelihood of children drinking tap water. Children, whose parents were educated at only the high school level and whose sponsor had a rank below E-6, were more likely to drink tap water than children whose parents had some college and had attained a rank of E-6 or greater.

CONCLUSION

It is the responsibility of in-processing and family housing personnel at Fort Irwin to continue to educate incoming soldiers and their families about the hazards of drinking or cooking with tap water. Official personnel should target soldiers whose rank is below E-6 and whose educational level is at or below high school. The children's mother, especially if she has not been educated past high school, should be targeted to receive additional warnings as to the hazards of drinking tap water. All incoming families should be advised to either drink RO or bottled water at Fort Irwin.

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APPENDIX

CODING AND DESCRIPTION OF QUESTIONNAIRE VARIABLES

Variable	Definition	Code
CASENBR	Case number	0003-4798
ONPOST	Are you living in post housing on Fort Irwin?	yes / no
CHILDREN	Are children residing in the household?	yes / no
BIRTHDT1-5	Dates of birth for up to five children	DDMMYY
RANK	Sponsor's rank	E-2 to O-6
EDUCDAD EDUCMOM	Father's educational level Mother's educational level	≤ High School > High School
INCOME	Household yearly income level	< $30,000 $30,000 - $39,999 ≥ $40,000
KNOWHARM	Knowledge about excessive fluoride. Do you know that additional fluoride can harm children's teeth?	yes / no
CHILDTAP	Attitude toward children drinking tap water with excessive fluoride. Is there a problem with children drinking tap water at Fort Irwin?	yes / no
BEHAVIOR	Behavior practices regarding children's consumption of tap water with excessive fluoride. Do children drink Fort Irwin tap water?	yes / no
KNOWFLO	How much do you know about fluoride?	Very knowledgeable Somewhat knowledgeable Know nothing about fluoride
IRWINTAP	Are you aware that your tap water has more fluoride than most drinking water in the US?	yes / no
ADDLFLO	Do you know what additional fluoride does to teeth?	yes / no
WHATHARM	What can additional fluoride do to to teeth?	Discoloration Fluorosis Strengthen teeth Weaken structure Other

Variable	Definition	Code
KNOWFLRS	Do you know what fluorosis means?	yes / no
TOTHPAST	Do you know that too much toothpaste swallowed at a young age may cause fluorosis?	yes / no
TABLETS	Do you know that too many fluoride tablets may cause fluorosis?	yes / no
FOODS	Do you know that certain foods such as fish, or drinks such as tea, may contain high levels of fluoride?	yes / no
TAPINF	Who told you about excessive fluoride in tap water at Fort Irwin?	Official channels Unofficial channels
ADULTS	Is there a problem for adults drinking tap water at Fort Irwin?	yes / no
COMBO	When children drink water or beverages made water, what type of water do they drink?	Tap RO Bottled Combination
WHYTAP WHYRO	Why do children drink tap water? Why do children drink RO water?	Tastes better Free of charge More convenient Better for you Other
WHYBTL	Why do children drink bottled water?	Tastes better Better for you Other
DENAPT	When was children's last dental appointment?	Within the past yr Two or more yrs
BRSHPST	At what age were your children's teeth first brushed with toothpaste?	≤ Age 1 ≥ Age 2
BRSHFRQ	How often were your children's teeth brushed with toothpaste?	Once a day or more < once a day

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